

NASA SBIR/STTR Technologies

S1.04-8039 - High Efficiency Semiconductor Arrays for Hard X-Ray Imaging



PI: Leonard Cirignano

Radiation Monitoring Devices, Inc. - Watertown, MA

Identification and Significance of Innovation

- Wide-field, hard X-ray coded-aperture imagers using high resolution semiconductor detectors will benefit from new materials offering higher efficiency and lower costs
- RMD is proposing TIBr semiconductor detectors for next generation instruments typified by ProtoEXIST and HREXI that seek to improve angular resolution, effective area, and energy resolution
- TIBr offers considerably higher efficiency and has demonstrated very good energy resolution in pixelated designs
- TIBr is an easy to grow material and binary compounds can offer better substrate uniformity

Estimated TRL at beginning and end of contract: (Begin: 3 End: 4)

Technical Objectives and Work Plan

- RMD will work with the ProtoEXIST group at Harvard University to evaluate pixelated TIBr detectors
- RMD will fabricate 5 mm thick TIBr detectors as 600 μ m pitch arrays and up to 20 x 20 mm area
- Detectors will be hybridized to H0 ASIC chips using polymer epoxy processes, similar to that done with CZT
- Detectors will be tested for radiation damage induced by proton beams
- Harvard will evaluate hybridized arrays for spectroscopy, depth corrections, distortions

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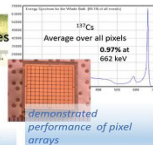
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TIBr detector

technology for
hard X-ray telescopes

large detector options
for high efficiency and
lower costs

continuous 1+
year operation



NASA Applications

- TIBr is an option for next generation hard X-ray telescopes in Medium Class Explorer (MIDEX) missions
- Optimal for extending the energy range of large monolithic detector arrays

Non-NASA Applications

- TIBr is being developed for homeland security applications requiring good energy resolution for isotope ID and compact instrument formats
- TIBr is candidate for nuclear medicine imaging offering increased photofractions and less Compton scattering
- TIBr is a replacement technology for small scintillators in handheld and portable instruments e.g. personal radiation detectors, surgical probes

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NON-PROPRIETARY DATA

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